VIDEO GAMING DEVICE AND COMMUNICATIONS SYSTEM

Background of The Invention

5   The present invention relates to video gaming systems and, more particularly, to improvements in communications, accounting and security systems for video gaming machines.

     In many areas, it is necessary to provide a
10   relatively detailed accounting of each video gaming machine's activity to assure that the machine operates within regulated standards. Meters are often provided to track money input into and money dispensed from the machines. Because money may sometimes be inserted to
15   a machine but not wagered, for example where a player inserts a certain amount of cash or credit but cashes out before betting the entire amount, the simple ratio of money in to money out does not accurately reflect the machine's operational activities. Accordingly, it
20   is helpful to also track the amount of money wagered and the amount of money or credits won by the player.

     In larger facilities such as casinos, a central computer typically monitors such information for a plurality of embedded system single player gaming
25   machines through a "location controller." Each video gaming machine serially communicates with the location controller to provide appropriate information to the central computer. If the central computer detects an irregularity regarding a particular game, it instructs
30   the location controller to deactivate the game. An exemplary system including a location controller and embedded system circuitry at a video gaming machine for providing information to the location controller is disclosed in U.S. Patent 5,429,361 and U.S. Patent
35   5,470,079, the entire disclosure of each of these

patents being incorporated herein by reference for all purposes.

<div style="text-align:center">OBJECTS   OF THE INVENTION</div>

The present invention recognizes and addresses disadvantages of prior art construction and methods.

Accordingly, it is an object of the present invention to provide a video gaming machine system   – having improved communication with a central computer.

It is an object of an embodiment of the present invention to provide a video gaming machine system in which video gaming machines communicate with a central computer without the use of a location controller.

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate one or more embodiments of the invention and, together with the description, serve to explain the principles of the invention.

SUMMARY OF THE INVENTION

The invention provides an interface device for use in a video gaming device which includes: .

(a)   at least one serial port which has a transmit line for transmitting data to a player station and a receive line for receiving data from a player station,

(b)   input port means and output port means for communication with a game computer, and

(c)   processing means for routing data between the said send port and the input and output port means.

Buffer means may be provided between the serial port and the processing means.

The input port means may include an input buffer and a serial port, and the output port means may include a port and an output buffer.

The device may include means for connecting the processing means to input and output devices.

Preferably the input devices are selected at least from player input buttons or keys, currency acceptor devices, and magnetic and integrated circuit card readers, and the output devices are selected at least from lamps, digital output displays, meters, currency return devices, token dispensers, ticket dispensers and magnetic and integrated circuit card writers.

The invention also provides an interactive video gaming device which includes an interface device of the aforementioned kind, a game computer which is connected to the said input port means and output port means, and at least one player station which is connected to the said serial port.

The game computer may be connected to a central computer.

The device may include a plurality of player stations which are connected in a daisy-chain arrangement to the said serial port.

Alternatively the device includes a plurality of player stations which are connected in a star arrangement to respective said serial ports of the interface device.

The invention further extends to an interactive video gaming device which includes a game computer which is connected to a central computer and a plurality of player stations connected to the game computer.

The invention also provides an interactive video gaming device which includes a central computer and a plurality of daisy-chain connected video gaming machines selected from single player video gaming machines and multiplayer video gaming devices connected to the central computer, each single player video gaming machine including a game computer.

According to a different aspect the invention provides a multiplayer video game which

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includes a game computer, a daisy-chain configuration of a plurality of player stations connected to the game computer, a central computer and a location controller connected to the central computer and the player stations.

The invention also provides a multiplayer video game which includes a game computer, a daisy-chain configuration of a plurality of player stations connected to the game computer, a location controller, connection means between the location controller and the game computer, and a central computer connected to the location controller.

The invention further extends to a player station for a video gaming machine which includes processing means, first serial input and output ports which are connectable to an interface device, second serial input and output ports which are connectable to a central computer or other similar player stations, a plurality of input devices, a plurality of output devices, and control means connecting the input devices and the output devices to the processing means.

The invention also provides a method of operating a gaming system which includes the steps of transmitting data directly between at least one player station and a game computer, and transmitting data directly between the game computer and a central computer.

The method may include the step of transmitting data successively between a plurality of the said player stations which are serially connected to the game computer.

Preferably the method may include the step of transmitting data between the game computer and each of a plurality of player stations which are connected in a star arrangement to the game computer.

The method may also include the step of transmitting data between a plurality of single player video gaming machines and the game computer.

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The invention also extends to a method of operating a gaming system which includes the steps of transmitting data between a daisy-chain configuration of a plurality of player stations and a game computer, and of transmitting data, via a location controller, between the said configuration and a central computer.

Brief Description of the Drawings

A full and enabling·disclosure of the present invention, including the best mode thereof, directed to one of ordinary skill in the art, is set forth in the specification, which makes reference to the appended drawings, in which:

Figure 1 is a perspective view of a multiplayer interactive video gaming device for use in a system constructed in accordance with the present invention;

Figure 2 is a block diagram illustration of a preferred embodiment of a player station that may be used in a multiplayer interactive video gaming device as in Figure 1;

Figure 3 is a block diagram illustration of a preferred embodiment of an interface device/used in a   or concentrator multiplayer interactive video gaming device constructed in accordance with the present invention;

Figure 4 is a schematic diagram of a preferred embodiment of player station hardware used in a multiplayer interactive video gaming device constructed in accordance with the present invention;

Figure 5 is a schematic illustration of a preferred embodiment of an interface device/used in a   or concentrator multiplayer interactive video gaming device constructed in accordance with the present invention;

Figure 6 is a partial schematic diagram of a preferred embodiment of a multiplayer interactive video gaming device for use in a system constructed in accordance with the present invention;

Figure 7 is a block diagram illustration of a preferred embodiment of a multiplayer interactive video gaming device in a daisy-chain arrangement;

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Figure 8 is a block diagram illustration of a preferred embodiment of a station architecture used in a multiplayer interactive video gaming device in a daisy-chain arrangement;

Figure 9 is a schematic illustration of an embodiment of a video gaming system in accordance with the present invention;

Figure 10 is a schematic illustration of an embodiment of a video gaming system in accordance with the present invention;

Figure 11 is a schematic illustration of an embodiment of a video gaming system in accordance with the present invention;

Figure 12 is a schematic illustration of an embodiment of a video gaming system in accordance with the present invention;

Figure 13 is a schematic illustration of an embodiment of a video gaming system in accordance with the present invention; and

Figure 14 is a schematic illustration of an embodiment of a video gaming system in accordance with the present invention,

Repeat use of reference characters in the present specification and drawings is intended to represent same or analogous features or elements of the invention.

Detailed Description of Preferred Embodiments

Reference will now be made in detail to presently preferred embodiments of the invention, one or more examples of which are illustrated in the accompanying drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will apparent to those skilled in the art that modifications and variations can be made in the present invention without departing from the scope or spirit thereof. For instance, features illustrated or described as part of one embodiment may be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations.

Figure 1 depicts a presently preferred embodiment of a multiplayer interactive video gaming device, indicated generally at 10. A cabinet A is divided into player portion 12 and a display portion 14. Display portion 14 and player station 12 are attached by a connection piece (not visible in the view shown) through which communication and power lines may be passed. It should be understood, however, that various cabinet configurations are possible. For instance, the player portion and the display portion may be unitarily constructed. Multiplayer video gaming devices are described in U.S. Patent 5,688,174 and U.S. Patent Applications 08/885,276 and 08/903,086. The entire disclosures of the '174 patent

and the `276 and `086 applications are incorporated by reference herein for all purposes.

Player portion 12 is constructed to simulate a casino blackjack game table. Three player stations 16 are disposed on the top counter surface of player portion 12. Each player station 16 includes a keypad 18 and a currency acceptor 20. Each keypad 18 includes a plurality of input keys 22 through which players participate in the blackjack game. In the embodiment shown, the currency acceptor is a bill acceptor configured to receive bills of various denominations. The currency acceptor could also accept coins.

In this embodiment, each keypad 18 includes a first row of five, and a second of two, input keys 22. It should be understood by those ordinary skill in this art that the use, number, and arrangement of such keys can depend upon the nature of the video gaming program operated within the present invention. For example, a blackjack game may require the use of different keys for different purposes than a poker game. Bill acceptor 20 accepts bills for betting and/or game fee purposes.

A ticket dispenser 19 is mounted at each player station. Players may "cash out" at any time by inputting a proper command at their player station. Upon cashing out, a printer mounted within the cabinet prints a redeemable ticket indicating the player's winnings via ticket dispenser 19. In other embodiments, a single printer is provided in the cabinet to print redemption tickets for all players.

A functional illustration of a player station 16 is provided in Figure 2. As indicated above, the player station includes a plurality of input devices 24, which may include, for example, player input

buttons 22 and currency acceptor devices such as bill
acceptors 20 (Figure 1). Player station 16 also
includes output devices 26, which may include lamps,
digital output displays, meters and/or currency return
devices such as token dispensers or ticket dispensers
19 (Figure 1), which output currency to players in the
form of redeemable tickets. Currency acceptor and
return devices may include magnetic card
readers/writers and IC card readers/writers to accept
and/or pay out currency electronically.

Player input messages are transferred from the
player stations to a workstation/including a game
processor running the video gaming program. The
workstation may include a data port, such as a serial
port or a keyboard port, an input/output system, and a
suitable communication arrangement communicating with
a remote game computer. Accordingly, a workstation
assembly may comprise a local computer, to receive
input from a plurality of player stations, and a
remote computer, to receive input signals from the
local computer and execute the game program
responsively to such signals. The local and remote
computers may communicate through any suitable
arrangement, for example telephone systems or local
area network systems. The remote computer's game
processor thereby receives input signals from the data
port of the local computer. In this arrangement, a
single game processor may operate a plurality of
remote player station groups. Alternatively, a
workstation assembly may comprise a remote computer
and a communications system, such as a telephone
system or local area network system, through which
multiple player stations communicate with the remote
computer. Thus, a plurality of single-player stations
separated by relatively long distances may participate

in a single-player or multi-player game operated by
the remote computer.

Additionally, however, the workstation may be a
personal computer assembly including an input/output
system, one or more data ports and a game processor
device in a local unit. As should be understood in
this art, a personal computer is a relatively small,
for example as compared to a main frame, computer that
is typically designed for use by a single user or by
multiple users through a network. It employs
components such as a central processing unit (CPU),
memory, and an input/output system by means of an
operating system such as WINDOWS95. The CPU is an
integrated circuit "chip" that can perform a multitude
of operations. The input/output system manages data
handling among the CPU and other internal or external
components. Thus, the personal computer is a general
purpose computer, as opposed to single-program
"embedded" system, which may include a dedicated
processor device mounted on a printed circuit board
and configured to perform a single function. A
personal computer assembly may be a board including a
processor and an input/output system. It may also
include a cabinet and/or various external and internal
components, as should be understood in this art.

Because it is a multipurpose device, the personal
computer assembly typically has no permanent input or
output device having direct communication to the
circuit board or, if there is more than one board, to
the main circuit board. Instead, data is conveyed
between input and output devices and the input/output
system by data ports. These ports may have
predetermined uses, for example to receive input from
a keyboard or a mouse or to direct output to a printer
or monitor. Personal computers also often include

expansion slots for additional circuit boards which
may, in turn, include their own data ports.

Although a personal computer assembly is the
workstation type most often discussed herein, it

5   should be understood that this is for exemplary
purposes and that all workstation configurations,
provided they are suitable for a given embodiment, are
within the scope and spirit of the present invention.
The remote computer in any of these arrangements may

10   operate a progressive jackpot feature in which all
communicating player stations may participate.

The player input message is the information input
at the player station, for example by player
activation of a button or bill acceptor or by system

15   activation of a maintenance condition at a token
dispenser, and conveyed to the personal computer
through the player station and interface assembly
equipment. During the transmission, the message may
take a variety of forms. For example, in a preferred

20   embodiment as illustrated in the figures, one type of
player input message may be input by pressing a button
22 (Figure 1). As discussed in more detail below,
this delivers a signal, for example a pulse, to the
player station control mechanism, which identifies the

25   pulse and selects an appropriate ASCII input code.
The player station outputs the ASCII input code to the
interface assembly, where the interface assembly
control mechanism converts the input code to a scan
code for transmission to the personal computer.

30   Another type of player input message may be input
by activating a bill acceptor. The bill acceptors may
deliver input signals to the player station control
mechanism in a variety of forms, for example as a
series of pulses or as a digital word. It should be

understood that all such configurations are included
within the scope and spirit of the present invention.

The internal components of player station 16 are
illustrated functionally in Figure 2 by player station
processing system 28, transmitting buffer 30 and
receiving buffer 32. In a preferred embodiment,
processing system 28 receives data directly from input
devices 24. If many input devices are employed on a
player station, however, it is possible to create a
row/column matrix for routing data via multiplexing to
the processing system, as should be understood in this
art.

In operation, if the processing system 28
detects, for example, a falling pulse indicating that
a particular button has been pressed, the processing
system associates the pressing of that button with an
appropriate code. In a present embodiment, the code
is a four character message. The first character
indicates that the message is beginning. The second
character indicates the message type, which identifies
the message as, for example, a button message or a
dollar bill acceptor message. The third character
provides the message information, for example that
button number three has been pressed. The fourth
character indicates the end of a message. The coding
prevents information loss and/or message scrambling
when the messages are queued or dequeued.

After creation of the appropriate code, the
message is stored in transmitting buffer 30. A
serial port 34 is provided on player station 16 to
output the data stored in buffer 30. The serial port
converts data from a parallel format to a serial
format to transmit and converts from a serial format
to a parallel format to receive. Status signals
indicate whether the transmitter is available (empty)

and whether the receiver contains data (full). Two
data lines, transmit line 36 and receive line 38, are
connected to serial port 34. Processing system 28
monitors a status signal associated with transmit line
36. When a "transmitter empty" condition is
indicated, the next message character in transmit
buffer 30 is transmitted through serial port 34 along
transmit line 36.

Data received from receive line 38 through serial
port 34 is stored in receive buffer 32. Processing
system 28 receives messages from buffer 32 and acts
according to instructions provided thereby. Thus,
processing system 28 may be caused to illuminate lamps
at the player station, dispense coins through a token
dispenser, print a cash out ticket, or other desired
functions.

In a star arrangement, each player station 16
communicates with a central interface device for
transferring player input messages to the game
computer. As illustrated in Figure 3, each player
station communicates by its respective transmit line
36 and receive line 38 with an interface device or concentrator 40
via serial ports 42. Five player stations may be
employed within the construction illustrated in Figure
3, although less than five, for example three, may be
used. In a daisy-chain arrangement as illustrated in
Figure 7, the player stations may be connected in
tandem so that messages move in and out of successive
player stations until reaching the central interface
device. Each player station includes an additional
serial port and buffer, and each player station
processing system generates new messages to the next
player station to pass on a message received from a
prior player station.

Referring again to Figure 3, interface 40 includes receive buffers 44 and transmit buffers 46 corresponding to each player station. An interface processing system 48 controls the transfer of an information between the receive buffers 44 and interface output buffer 50 and between an interface input buffer 52 and the transmit buffers 46. When processing system 48 receives an incoming message from a receive buffer 44, the processing system converts the message to a scan code which the operating system on the game computer will recognize. The scan codes are routed to and stored in transmit buffer 50, which communicates with the game computer via interface keyboard port 54. A transmit line 56 connects interface keyboard port 54 with a game computer keyboard port. Processing system 48 monitors transmit line 56 and, when no data is present on transmit line 56, outputs the scan codes stored in transmit buffer 50 to the game computer over transmit line 56 through keyboard port 54.

The scan codes are received by the game computer through its keyboard port. The use of the game computer keyboard port has certain advantages. For example, general purpose computers are typically sold with operating systems configured to receive and recognize scan codes from the keyboard port. Thus, the game program may be constructed around the standard keyboard key strokes that the scan codes represent, and the video gaming programmer may rely on the built-in operating system to receive and process input data without having to program a custom data operating and error checking system. Some recent operating systems, for example WINDOWS95, receive and process data from operating system ports other than the keyboard port, for example certain COMM ports.

While the operating system does not recognize "key up" and "key down" events from these other ports, applications running on the operating system may otherwise take advantage of the operating system to deliver data from them. For illustrative purposes, not for purposes of limitation, communication by keyboard port is primarily discussed herein.

Data is routed between the player stations and the game computer through processing systems 28 and 48, illustrated in Figures 2 and 3, and the input and output buffer systems, without loss of information. Thus, if two players press input buttons at their respective player stations simultaneously, both input messages will be received by the game computer.

Commands from the game computer to player station output devices are transmitted to interface input buffer 52 via interface device serial port 58. Processing system 48 receives messages from buffer 52, determines to which player station the command should be forwarded, and stores the command in the appropriate output buffer 46 for transmission to the player station via the corresponding serial port 42. If the system is daisy-chained, only one transmit buffer is required. As each message is received by a player station, it is relayed to and examined by the next player station. If the message is found to be for this player station, that station's processing system performs the requested action.

Processing system 48 may also communicate directly with input devices 24 and output devices 26. These may include the same input and output devices discussed above with respect to the player stations. That is, the input and output devices of a single player station may be directly connected to interface device 40 without a player station processing system

28 and buffers 30 and 32 (Figure 2) that are associated with the individual multiple player stations. Thus, the game computer/interface assembly may be used with player stations of single player games which do not have such processing systems or buffers. Accordingly, the game computer/interface assembly may be used interchangeably with a multiplayer or a single player configuration. Video gaming machines may be constructed with removable player station units so that the game may be converted between a multiplayer game and a single player game simply by interchanging the player station unit or units. Provision may be made to reprogram or convert the game computer to a new or previously stored program to enable operation of the new game.

In another preferred embodiment, the interface device may be physically embodied on a player station so that this player station communicates with the game computer through the keyboard port. Other player stations output messages to the game computer through this first player station to avoid loss of information. Player station units may be linked to the first player station in a star or daisy-chain arrangement and may be added or removed to achieve a desired number of player stations.

As described above, processing system 48 receives incoming codes from the player stations and converts the codes to scan codes which the operating system on the game computer will recognize. Since there are a finite number of messages which will come from any player station, a unique scan code may be assigned to each particular message from each player station. This may be accomplished, for example, by converting player station messages into keyboard scan codes. Thus, in a preferred embodiment, each player station

includes similar input devices in a similar
arrangement and outputs the same messages for the same
corresponding devices. Processing system 48 assigns
scan codes based upon the player station message and
the player station itself. Thus, the assignment of
the scan code depends upon the particular message and
the particular player station from which the message
is received.

It should be understood, however, that various
suitable configurations are possible. For example,
while in a preferred embodiment the player station
processing systems assign ASCII codes as the player
station messages, various coding processes may be
employed. Thus, for example, scan codes could be
assigned at the individual player stations,
eliminating the need to make the assignment at the
interface device.

In the illustrated local unit embodiment, the
game computer is, preferably, an IBM PC/AT compatible
personal computer. Thus, the scan codes assigned by
processing system 48 are compatible with the operating
system provided on those computers. The operating
system is configured to receive the scan codes from
the computer keyboard port and to use those codes for
operating system functions and/or higher level
functions. In particular, the IBM PC AT compatible
computers may receive the scan codes and convert them
to ASCII codes, which may be output to a screen and
which may be used in commercial or custom software,
including the gaming program.

A schematic illustration of a player station is
provided in Figure 4. A plurality of buttons, which
for example may be installed in groups of up to eight
buttons 22 (Figure 1), are indicated at 60. Thus, if
three button groups are used, the player station may

include a total of 24 input buttons. A bill acceptor
20 is controlled by a series of dip switches 66, which
may be used to program the bill acceptor to, for
example, accept certain bill denominations and/or
select serial or pulse mode operation.

Output devices includes lamp groups 68 and
digital output groups 72. As with the button groups,
each lamp group and each digital output group includes
eight lamps and eight digital output devices,
respectively. It should be understood, however, that
all of the available input and output devices may not
necessarily be employed in a particular game; the
exemplary construction illustrated in Figure 4 merely
indicates that they are available. Other output
devices include a token dispenser and/or ticket
dispenser indicated at 78.

Data is transmitted to or from these input and
output devices on 8-bit data bus 80 and is controlled
by field programmable gate array 82. Gate array 82
may be, for example, a Xilinx XC3042 or XC5202 gate
array or other suitable device.

Data transfer from the player station is
controlled by a processor 84 which, in one preferred
embodiment, is an 8051-compatible microcomputer having
one or two on-chip serial ports. It should be
understood that other processing devices may be used,
for example those including on-board EPROMs. Although
processor 84 includes a certain amount of memory, SRAM
86 provides additional storage. Together, this memory
serves as the player station buffers. EPROM 88
provides storage for the programming for processor 84
and the look-up tables by which input codes may be
assigned to particular input signals. A PAL (not
shown), for example a 20V8 PAL, is provided to decode
the microprocessor address range into three ranges -

EPROM, processor and input/output devices, including the gate array.

In operation, processor 84 controls gate array 82 to input and output data to and from the input devices and output devices. An internal logic signal of the gate array 82 causes gate array 82 to send an interrupt signal to processor 84 every 25 milliseconds. In response to this interrupt command, processor 84 orders gate array 82 to sequentially place the contents of the data registers of the respective button groups on data bus 80. Thus, if a player presses one of the buttons in a particular button group, the corresponding position in the button group register in the gate array changes state. Following the next 25 millisecond interrupt signal, processor 84 causes gate array 82 to output the contents of that button group's register, in order among the other button groups, to common bus 80. In the embodiment depicted in Figure 4, a button group may include up to eight buttons so that each button position of the button group register may correspond to a data line on eight bit bus 80. Thus, of the eight data lines input to processor 84 from bus 80, seven are at a normal state while one has changed state due to the pressed button. Because processor 84 causes gate array 82 to output the button group registers to the common bus in a certain order, processor 84 knows which button group is connected to the common bus at any time. In this manner, the processor identifies the particular button group from which it receives an input message. The particular button or buttons within the button group is determined by the line or lines on common bus 80 that have changed state.

Once processor 84 determines that a particular
button in a particular button group has been pressed,
it generates an ASCII code corresponding to that
particular button. This can be done, for example,
either by an algorithm that is part of the processor
84 program or according to a lookup table stored in
EPROM 88. Once the code is established, it is
translated into a message which is stored in a
transmit buffer in SRAM 86 until processor 84
determines that the serial transmitter 89 of serial
port 34 is free. When the output line is free of
data, processor 84 outputs the stored ASCII codes from
SRAM 86 through serial port 34 to the output data
line.

If two or more buttons in a button group are
simultaneously pressed, processor 84 converts each
signal into a corresponding ASCII code and stores
signals in SRAM 86 according to a predetermined order,
for example depending upon the data line over which
they were received. The corresponding messages are
output through serial port 34 in the order in which
they are stored in SRAM 86. By this protocol,
simultaneous button activations are accommodated
without information loss.

This assumes, however, that the activation of all
the buttons represents information - data that the
game program should receive to operate properly. In
some games certain buttons, for example "Bet" or "Hit"
buttons, are inappropriate at certain times. While
the game program itself may be configured to ignore
the data resulting from these button activations once
such data is received, the program may control
processors 84 and 96/to mask (Figure 5) these buttons so that the
data is not forwarded to the game computer.
Additionally, the processors may be programmed to

recognize one or more button activations, and not
recognize one or more others, when buttons are
simultaneously activated where the latter buttons may
always be ignored in favor of the former buttons. In
any event, the video gaming device may be configured
to ignore button activations which do not represent
information while maintaining the ability to process
those simultaneous button activations that do.

Processor 84 may also receive inputs from bill
acceptor 20, token dispenser 78 and/or ticket
dispenser 19 through the gate array. Alternatively,
bill acceptor 20 may communicate directly with
processor 84 through serial port 85, as indicated by
dashed line 87. The inputs from bill acceptor 20
primarily relate to the amount of currency input by
the player. Inputs from the token dispenser generally
concern errors, for example that there are
insufficient tokens in the dispenser. Inputs from
ticket dispenser 19 may include error signals but may
also include signals indicating, for example, that a
ticket has been printed and dispensed.

These devices are programmed to output an
appropriate message to gate array 82 in a
predetermined format, for example ASCII hexadecimal.
Upon receipt of such a message, gate array 82 stores a
digital signal indicating the origin of the message
and sends a second interrupt signal to processor 84.
Upon receipt of this type of interrupt signal,
processor 84 reads the identifying signal stored in
gate array 82 and causes gate array 82 to pass the
input from that particular device to common bus 80
where it is read by processor 84. Processor 84
converts these messages, either by a program algorithm
or by a lookup table, to an ASCII code which is output
by serial port 34.

Processor 84 may drive a parallel printer 83 to print redeemable coupons. This arrangement may be used in place of a ticket dispenser that outputs preprinted tickets in fixed denominations. In

5 addition, a central printer driven by the game computer may be used instead of individual player station printers.

Data commands to a player station are received through serial port 34 by processor 84, which stores

10 the command in SRAM 86. The command will identify a particular output device, for example ticket dispenser 19 or a lamp in a lamp group 68. Assuming the latter, processor 84 writes appropriate data on bus 80 to drive the particular lamp, while preserving the

15 previous state of the other lamps in the group, and instructs gate array 82 to apply this instruction to the appropriate lamp group. Instructions to bill acceptor 20, token dispenser 78 and ticket dispenser 19 are generally in the form of digital words which

20 are downloaded to the particular devices through gate array 82. These output devices are configured to receive this information and act accordingly. The particular construction and configuration of these devices are well known in the art and need not be

25 described herein.

Player station 16 also includes two nonvolatile
RAM/real-time clocks 91/for maintaining data between
and 91A
power cycles and for power-off intrusion detection.
The battery-powered devices remember how many tokens

30 are deposited during a vend cycle as the tokens are being deposited. Thus, if the machine is to deposit ten tokens, but power fails after only six are deposited, the NVRAM/RTCs 91 notify processor 84 and/or the game computer that four additional tokens

35 should be deposited. As indicated in Figure 4,

NVRAM/RTCs 91 communicate with processor 84 through
gate array 82.

Two NVRAM/RTCs 91 are provided for error checking
purposes. During a vend cycle, for example, one
NVRAM/RTC 91 is incremented before a token is
deposited, and the other is incremented after the
token is deposited. Accordingly, following a power-
up, a vend cycle or a token deposition, microprocessor
84 detects an error if the registers of the two
NVRAM/RTCs do not agree. In this case, processor 84,
the game computer or a central computer may shut down
further operations of the player station 16 until the
error is resolved.

NVRAM/RTCs 91 also provide a security function.
In a preferred embodiment, switches are disposed at
the game machine's money pit and electronics pit so
that if the door to either is opened, a line is pulled
low. Each line is connected to a respective NVRAM/RTC
91 so that if it goes low, the memory register for the
respective NVRAM/RTC 91 is cleared. If processor 84
detects this condition, for example following power-up
or after a periodic scan, an error is detected, and
the processor or game computer stops the player
station's activity until the error is resolved.

Further, upon detection of an error processor 84
may output an appropriate message through serial port
34 to a central computer that, in turn, may provide
notification to an operator. In investigating and
attempting to resolve the error, the operator may
communicate with processor 84 through serial port 93
with an appropriate computer or other device. As
indicated in Figure 4, serial ports 93 and 95 are on-
chip ports of processor 84. Serial port 95 may be
used as an alternative port by which to communicate

with the central computer or other player stations, as
discussed in more detail below.

Player stations 16 communicate with the game
computer through a concentrator board 40 (Figure 3).
A schematic illustration of concentrator board 40 is
provided in Figure 5. In the star arrangement, each
player station communicates with concentrator board 40
from the player station's serial port 34 (Figure 4) to
a serial port on the concentrator board. Four serial
port groups 90 are provided on the concentrator board.
Each serial port group 90 includes four serial ports,
each having an input line and output line. Thus, each
serial port group has eight data lines in
communication with an eight bit data bus 92.
Accordingly, in the configuration illustrated in
Figure 5, sixteen player stations may be connected to
concentrator board 40, although in preferred
embodiments three or five player stations are
employed.

Field programmable gate array 94 controls
communication of data along bus 92 between a processor
96 and the ports and devices communicating with the
bus. Any suitable processing device, for example an
8051-compatible microcomputer, may be used. Gate
array 94, EPROM 98 and SRAM 100 may include the same
or similar components as the corresponding components
on the player stations.

EPROM 98 stores the program executed by processor
96. Processor 96 may include its own internal memory
for use as buffers. Preferably, however, SRAM 100 is
included to provide additional memory.

A player input message from a particular player
station is received at a serial port, which
communicates with that player station, in one of the
serial port groups 90, where it is stored in the

serial port group register. Upon receipt of an
interrupt signal periodically sent by gate array 94,
processor 96 instructs gate array 94 to sequentially
connect the register of each serial port group 90 to
5   the eight data lines of common bus 92. In this
manner, processor 96 is able to determine from which
serial port, and therefore from which player station,
it receives data. Processor 96 stores the incoming
data either in its internal memory or in SRAM 100.

10   As discussed above, the incoming messages are in
the form of ASCII codes. Processor 96, either by
computer program algorithm or by a look up table
stored in EPROM 98, assigns a scan code appropriate
for the particular ASCII character from the particular
15   player station. The scan code is then stored in SRAM
100.

Processor 96 monitors the status of keyboard
output port 102 by gate array 94. If the output data
line is clear, processor 96 outputs the stored scan
20   code from SRAM 100 over bus 92 to gate array 94 to
keyboard output port 102. Keyboard output port 102
communicates with the game processor via a personal
computer keyboard port.

Data may be downloaded from the game computer via
25   a keyboard input port 104 or serial port 106. If data
is downloaded to keyboard input port 104, gate array
94 sends a second interrupt signal to processor 96,
which then instructs gate array 94 to put the data on
common bus 92 for storage in SRAM 100. Data
30   downloaded through serial port 106 is stored by
processor 96 in SRAM 100. If the incoming message is
a command for a player station, processor 96 causes
gate array 94 to connect the appropriate serial port
in the appropriate serial port group 90 to common bus
35   92 and outputs the command to the common bus.

Concentrator board 40 also includes connections for button groups 108 and 110, lamp group 112, digital output device group 114, switches 116, bill acceptor 118, token dispenser 120, and ticket dispenser 122. These connections are provided for direct connection of their associated devices to concentrator board 40. Thus, concentrator board 40 may be configured to function as a single player station, operating as described above regarding player stations 16 (Figure 4). Thus, in a preferred embodiment, a game cabinet may be constructed housing a personal computer assembly and a concentrator board assembly wherein the player stations are removable. Thus, multiple player stations may be installed and connected to serial ports in serial port groups 90 for communication to the game computer through the concentrator board. The game may, however, be converted to a single player game by removal or deactivation of the multiple player stations and installation of a single player station whose components connect directly to the concentrator board 40 as indicated in Figure 5. Multiple alternative game and operating programs may be stored in, or programmed into, the game processor and the concentrator board processor so that they may operate in the new configuration. Thus, a game assembly may be convertible between a single player and a multiplayer configuration.

Although the button groups, serial ports, lamp groups and output device groups are illustrated in Figure 5 as being connected to bus 92 so that gate array 94 may selectively connect their registers to the bus, it should be understood that these devices may be connected to the bus through the gate array.

Figures 7 and 8 illustrate a daisy-chain arrangement of the present invention. In the

embodiment illustrated in these figures, a serial port of game computer 124 is the head of a bidirectional RS-232 network implemented using intelligent controller cards, each having two serial communications ports termed the "up" and "down" ports. In general, commands from the game computer flow first into the concentrator up port, the first external node in the network. Commands from the game computer are echoed to the concentrator down port and output to the first player station, player station 16a, up port. If the command is intended for processing by this player station, the command message is parsed and queued. Otherwise, the message is echoed to the player station's down port and output to the next player station up port. Player input messages generated by the player station and player input messages received from other player stations through the player station's down port are queued and dequeued, for example in round-robin fashion, to the station's up port as complete messages as they become ready.

Command messages and player input messages are processed at the non-interrupt level. Serial port buffers are managed at the interrupt level. This prevents loss of data when the processor is busy with local tasks.

In this fashion, command messages are passed from the game computer to specific player stations, and input messages from the player stations are passed up to the game computer. The concentrator 40 receives command messages from the serial communications port of game computer 124. It routes input messages from player stations to the game computer through its keyboard port. Thus, input messages may be directed to the computer as keyboard scan codes as described above.

Each of the tandemly-linked player stations
illustrated in Figure 7 may be configured as shown in
Figure 4 with the use of serial ports 34 and 95.
Thus, one of the serial ports is used as the up port,
and the other is used as the down port. The up ports
and down ports are bidirectional. Thus, assuming
player station 16 illustrated in Figure 4 is player
station 16b illustrated in Figure 7, the up serial
port 34 receives command messages from, and outputs
input messages to, the down port of player station
16a, while the down port receives input messages from,
and outputs command messages to, the up port of player
station 16c. Command messages received by the up port
are stored in SRAM 86. The command message includes
an identifier indicating for which player station it
is intended. Processor 84 reads the identifier and,
if the command message is intended for player station
16b, acts upon the message as described above. If,
however, the command message is intended for player
station 16c, processor 84 directs the message to the
down port for output to player station 16c.

Player station 16b receives input messages from
player station 16c through its down port and stores
them in SRAM 86. Since these messages are intended
for the game computer, processor 84 directs them to
player station 16a through the up port. The input
messages from player station 16b are also passed to
player station 16a through the up port.

Processor 84 may simultaneously receive and store
messages from its dual serial ports (the up and down
ports). If a message is to be passed through the
player station, processor 84 may simply direct the
message from one serial port to the other, or it may
place the message on SRAM 86 for output at a later
time. In any event, a player station may process

command and input messages received from external
sources while generating its own input messages
without losing information even if, for example, a
command message and an input message are received at
the same time a button is pressed at the player
station. Thus, from the perspective of player station
16b, the interface between it and game computer 124 is
concentrator 40 and player station 16a.

A receive-only serial device, such as sign 142,
may be connected on the end of the chain. The network
messaging protocols may be designed to allow other
devices to be connected without mutual interference.
That is, the message formatting for the player station
network may be different than that used by the sign,
and the two protocols may coexist without
interference.

Figure 8 illustrates one preferred player station
network architecture. There are three distinct
processing levels for handling network traffic. At
the hardware level, two standard on-chip serial
communications ports handle all data serialization and
deserialization. At the interrupt level, the on-board
processor handles characters received from or sent to
the serial ports. At the interrupt level, the
processor manages two receive buffers and two transmit
buffers. At the applications level, where all of the
application's code has the same execution priority,
the processor queues and dequeues messages in three
queues. An input queue holds parsed command messages
for processing by the application firmware. Two
output queues hold complete input messages from the
player station to be passed, using an arbitrary
prioritization scheme, to the up port's output buffer.
Round-robin prioritization, for example, may be used
to empty the output queues.

The above description illustrates both a star and daisy-chain arrangement. The concentrator and player stations support either topology. While the concentrator arrangement may exhibit superior

5 performance, the daisy-chain arrangement is, generally, less expensive. The choice among star, daisy-chain and a combination of the two arrangements will depend upon the requirements of a specific application.

10 Referring now to Figure 6, personal computer assembly 124 houses a game processor such as a CPU 126, for example a PENTIUM processor, for executing a blackjack gaming program responsively to the player input messages from player stations 16 (Figure 4). An

15 input/output system such as a BIOS 128 receives the input messages from concentrator board keyboard output port 102 (Figure 5) by keyboard port 130 and bus 132. BIOS 128 outputs a signal to CPU 126 over a bus 134. As should be understood by those of ordinary skill in

20 the art, BIOS 128 may decode or encode signals received by CPU 126 depending upon, for example, the configuration of the personal computer assembly.

Moreover, a variety of circuitry configurations are possible within the range of personal computers.

25 For example, a variety of input/output, memory (for example RAM 136), buses, and other devices may be arranged in various suitable configurations. Furthermore, various methods may be employed utilizing such devices and configurations in communicating

30 information between keyboard port 130, or other suitable data input port, and CPU 126. It should be understood that all suitable such personal computer configurations may be employed in accordance with the present invention.

As it executes a video card gaming program, CPU
126 outputs video display signals to a monitor 138 via
a parallel port 140. The video card gaming program
executed by CPU 126 permits interactive participation
5   by a plurality of players at player stations 16
(Figure 1).

The video card gaming program is preferably
written in an "event-driven" language such a Visual
Basic or Visual C. An event-driven program performs
10   operations responsively to "events," such as the
depression of a push button that, in turn, causes BIOS
128 to output a signal to CPU 126. As should be
understood by those of ordinary skill in this art,
personal computers are generally equipped with
15   operating systems which are configured to manage
communication between the personal computer and the
software programs. In particular, the operating
system is configured to recognize certain signals, for
example scan codes received by the keyboard port and
20   to convert such signals into predetermined codes, for
example ASCII codes, which may be utilized by the
program. In a preferred embodiment, personal computer
assembly 124 is an IBM-compatible system using a
MSDOS-compatible operating system. The scan codes
25   assigned by the concentrator board (Figure 5) are
converted by the operating system to ASCII codes which
are utilized in operation of the video card gaming
program.

Although a variety of card gaming programs may be
30   utilized in accordance with the present invention, in
one presently preferred embodiment CPU 126 is
configured to execute a blackjack game wherein the
gaming program generates a "dealer's" blackjack hand on
monitor 138 that is visible to the players at the
35   player stations. The players submit wagers, accept or

reject card "hits," and select game options via the
keys at the player stations. The player's hands are
displayed on monitor 138 along with the dealer's hand
in a manner similar to the display of cards on a
casino blackjack table. Various versions of the basic
blackjack or "21" game are known and may be employed
in accordance with the present invention.

Various types of metering devices may be employed
within the system. For example, an "in" meter may be
used to count the amount of money put into the gaming
machine. The construction of such meters, which
should be well understood in the industry, need not be
described herein. Typically, however, the meter is a
relatively simple counter which is incremented by
pulses. The in meter may be implemented within a
system of meters 101 as shown in Figure 4. Thus, one
or more such meters may communicate with common bus 80
directly or through gate array 82.

In operation, the game computer may receive data
from a player station's bill acceptor 20 corresponding
to an amount of currency accepted. The game program
recognizes this amount and causes the game computer or
processor 84 to output an appropriate number of pulses
to the in meter so that the in meter properly
increments, thereby recording the amount of money
input at the player station. The number of pulses
sent to the meter depends upon the denomination by
which the meter is to count. For example, if the
machine accepts currency in dollar, or greater,
increments, the meter may increment for each dollar
input at the machine or player station. Thus, if a
player inputs a five dollar bill, the meter is
incremented five times.

By controlling the meter through the game
program, various types of bill acceptors may be used,

for example those which output data by pulses or by digitally formatted signals. Various types of currency may be accepted, for example paper, coins or electronic media.

5   Other such meters may be attached within the system in a similar fashion for other purposes. For example, the game program may increment an "out" meter to record the amount of money cashed out at the machine or player station, for example through a coin

10   or bill hopper, ticket dispenser or electronic output mechanism. The program may also increment a "credits played" meter, to record how much money is wagered at a player station, and a "credits won" meter, to record the amount of money returned to the player station as

15   winnings. Additionally, switches may be provided at certain game doors, as described above, so that the game computer is notified of openings and/or closings. Upon notice of a door or drawer opening, the game computer may increment a meter installed for this

20   purpose. Such an arrangement may serve a security purpose, since the game's owner or operator may monitor the meter to assure that the game has not been opened since the previous meter reading. It should therefore be apparent that various game "events" may

25   be metered using the arrangement and construction of the present invention.

        The meters may be employed in a variety of game configurations. For example, as described above, they may be used in conjunction with an interface assembly

30   as described herein that facilitates communication between player stations and a workstation running the game. They may also be used, however, in arrangements without such an interface assembly, such as embedded systems or networked player stations not employing a

35   common interface. In an embedded system, the meters

can communicate with a dedicated processor on a printed circuit board directly, for example through direct wiring to the circuit board, or indirectly, for example through processors at the player stations. The dedicated processor can increment the meters appropriately as events, such as money in, money out, money wagered, money won and door openings or closings, occur. In the networked arrangement, the meters may be incremented by a server, either directly or through the player stations, or by player station processors.

As noted above, one or more meters may be employed to record data for each player station. Alternatively, in a multiplayer game, a group of meters may be used to record such data for the multiplayer game as a whole, rather than per player station. Such meters may be attached as peripheral devices to the concentrator board 40 (Figure 5) or to one of the player stations. Furthermore, meter groups, whether for use with the gaming machine as a whole or with individual player stations, may be placed on their own boards. Such a board may include, for example, a memory device, a microprocessor and, possibly, an FPGA. Its construction and operation would be similar to that of the player station 16 arrangement illustrated in Figure 4, but on a smaller scale. In a star arrangement, such a board could communicate with an interface processing system 48 by a serial port 42 (Figure 3). In a daisy-chain arrangement, the meter board, or boards, may be linked with the player stations.

Moreover, the player stations themselves may be constructed by multiple such boards, each containing a certain group of input and/or output devices. Thus, a player station may have a board for its meters and a

separate board for its buttons. In this manner,
defective components may be replaced without requiring
replacement of the entire player station hardware.
Further, a cabinet may be more easily reconfigured to

5   play a different game which might require a different
configuration of certain player station devices.
Moreover, it should be recognized that the hardware
arrangements illustrated in the figures are for
illustrative purposes only and are not intended to

10 limit the present invention. For example, the gate
arrays on the player stations and the concentrator
board could be replaced with other appropriate
circuitry. Accordingly, it should be understood that
any suitable design is within the scope and spirit of

15 the present invention.
        Figure 9 illustrates a system in which video
gaming machines may communicate with a central
computer without a location controller. In Figure 9,
a multiplayer video gaming machine 10 includes a game

20 computer 124 (for example a personal computer)
communicating with three player stations 16 through a
concentrator board 40 in a star configuration. As
noted above, game computer 124 receives information
from, and outputs information to, each player station

25 16. Thus, game computer 124 is able to calculate all
metering data associated with each individual player
station. Game computer 124 communicates this
information to a central computer 140 through a modem
142 or, for example, a direct wire link from a data

30 port on computer 124. Modem 142 may be an on-board
modem within computer 124 or a separate modem with
which the computer communicates by a modem card.
        In this manner, computer 124 provides security
and activity information for each player station 16.

35 For example, messages from computer 124 to central

computer 140 may include an address that identifies a
given player station so that the central computer can
identify the message with that player station and
respond accordingly. For example, in systems where a
5   location controller identifies a particular game by
the port over which data is received and outputs
serial data to the central computer identifying the
game, the game computer 124 may be programmed to
communicate with the central computer using the same
10   protocol used between the central computer and the
location controller. Thus, the present invention may
replace a location controller in an existing system
without requiring that the central computer be
reprogrammed.

15   The game computer may provide a variety of data
to the central computer. For instance, if game
computer 124 receives a message from a player station
that its money pit door has been opened without
authorization, this information may be provided to
20   central computer 140 so that the central computer may
take appropriate action directed to that player
station. For example, the central computer may direct
an operator to the player station and/or instruct game
computer 124 over modem 142 to shut down operation of
25   the player station. In the latter case, the return
message from the central computer to game computer 124
includes an address or other code structure
identifying the player station to which the
instruction applies.

30   As noted above, game computer 124 receives all
metering information, for example money in, money out,
credits played and credits won, from player station
16. It is therefore able to communicate this
information to central computer 140 through modem 142.
35   If central computer 140 at any time determines that a

player station 16 is operating improperly, for example
by not maintaining an appropriate return ratio, the
central computer may issue a command to game computer
124 to shut down that player station.

5   Concentrator board 40 may also communicate with
single player video gaming machines 144 that would
otherwise communicate with central computer 140
through a location controller. These are conventional
video gaming machines configured to output serial data
10   to a location controller. In this embodiment,
however, the data line from each game 144 is directed
to a serial port 42 (Figure 3) of concentrator board
40. As should be understood in this art, information
directed to the location controller is provided in a
15   standard protocol. Thus, the concentrator board
processor is programmed to read such signals and to
output signals to game computer 124 that include the
information carried by the signals from the single
player games and that identify the particular games
20   144 from which the information was received. If the
single player games are not adapted to provide an
identifying address or code in their output signals,
the concentrator board processor may be programmed to
add this information, identifying a game 144 by the
25   particular serial port from which a signal was
received. Game computer 124 may be programmed to
output all signals, whether pertaining to player
stations 16 or single player games 144, in a format in
which central computer 140 would expect to receive
30   information from a location controller.

        Central computer 140 may also issue instructions
to shut down a game 144 that is not operating
properly. Game computer 124 receives this instruction
and outputs an appropriate signal to the concentrator
35   board in response. The concentrator board processor

then directs an appropriate instruction, for example in a format in which the game 144 would expect to receive such an instruction from a location controller, to the serial port corresponding to the

5   appropriate game. Game computer 124 identifies the appropriate game 144 in its message to the concentrator board processor.

The system may also be effected in a daisy-chain arrangement. One such arrangement is illustrated in

10   Figure 10, in which game computer 124 communicates with a first player station 16 which tandemly communicates with two downstream player stations. As discussed above with respect to Figure 4, the first player station communicates with game computer 124 and

15   the subsequent player station 16 through its serial ports 34 and 95, and the second player station 16 communicates with the upstream and downstream player stations through its serial ports 34 and 95. The final player station 16 communicates with its upstream

20   player station and a concentrator board 40 through its ports 34 and 95.

The concentrator board 40 may be constructed as illustrated in Figure 3, except that the keyboard port 54 is not used. Specifically, concentrator board 40

25   communicates with the upstream player station 16 and each of the single player games 144 through respective serial ports 42. When the concentrator board processor receives information from a particular game 144, it identifies the game (either by data included

30   in the message or by the identity of the particular serial port from which the information was received) and outputs a message to the upstream player station 16 that identifies the nature of the message (i.e., that it is intended for the game computer 124 rather

35   than one of the player stations), the identity of the

game 144, and the message information. As discussed above with respect to daisy-chain configurations, the upstream player stations pass the message on to game computer 124 that, in turn, outputs an appropriate message carrying the information to central computer 140. Central computer 140 may communicate with player stations 16 and single player games 144 through game computer 124, which directs messages down the chain to a particular player station as discussed above or to concentrator board 40 for output to the serial port 42 (Figure 3) corresponding to the particular game 144.

As noted above, concentrator board 40 is able to operate player station components. Thus, rather than adding an additional board, concentrator board 40 may be used in place of the last player station 16 in Figure 10 while also directing message traffic to and from the games 144.

As an alternative to the concentrator board arrangement illustrated in Figure 10, each game 144 may be retrofit with a board having a processor, at least three serial ports and appropriate memory, for example using such components as described above regarding the player station board illustrated in Figure 4. It should be understood, however, that the game boards may employ any suitable circuitry, for example replacing the processor with suitable logic circuits.

The first game board serial port is used to communicate between the board and the game 144. This function may require an additional serial port, one for input and one for output, depending on the game's configuration. The other two serial ports perform the "up" and "down" functions as described above with respect to daisy-chained player stations. That is, one serial port is used to communicate with downstream

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devices while the other is used to communicate with
upstream devices. Thus, a message intended for a
particular game 144 may be output from the last player
station to subsequent game boards until the message

5   reaches the board on the correct game. The message
includes an address identifying the game so that it is   —
recognized by the game board's processor, which then
outputs an appropriate message to the game through the
first serial port. Messages from the game 144 to the

10   central computer are output through the game board
first serial port and are directed by the game board
processer to the game board up port for output to
upstream game boards and player stations to the game
computer 124, which then communicates with central

15   computer 140. Tandemly linked player stations
retrofit with such boards are schematically shown in
Figure 11. In an alternate arrangement, the
upstreammost game 144 may output directly to a data
port of game computer 124, as shown by a dotted line 147.

20   As noted above, a single player video gaming
machine may be constructed using a game computer and a
single player station 16 or concentrator board 40 as
discussed above with respect to Figures 4 and 5. In
this case, any number of single player or multiplayer

25   games may be daisy-chained together as shown in Figure
12. The game computer of each downstream game
communicates with its adjacent upstream game by a data
port on the upstream game's game computer or by a
player station serial port. The game computer of the

30   upstreammost game communicates with central computer
140 through a modem 142 or through·a direct line
connection from a data port of the game computer.
Where enough serial ports are provided on the player
stations, all upstream and downstream communications

35   may be effected through player station serial ports.

Moreover, it should be understood that various
suitable configurations are possible. For example, a
game computer having USB technology can communicate
with up to 127 serial devices on each USB port. Thus,
5   a game computer having one or more USB ports could
perform the function of concentrator board 40 in
Figure 10. It should be understood that all suitable
arrangements and component configurations are included
within the scope and spirit of the present invention.

10   Multiplayer video gaming devices in accordance
with the present invention may be employed in existing
systems having location controllers. Referring to
Figure 13, a multiplayer game 10 includes a game
computer 124 and three player stations 16 arranged in
15   a daisy-chain configuration as discussed above.
Referring also to Figure 4, each player station has
four serial ports. Two of the serial ports 34 and 95
function as the up and down ports. One of the other
ports 85 and 93, however, communicates with a location
20   controller 146. Player station processor 84 is
configured, in conjunction with game computer 124, to
output information corresponding to each particular
player station in the same output format as games 144.
Thus, central computer 140 and location controller 146
25   are able to treat each player station 16 as if it were
a separate game.

Instructions directed from the central computer
to a player station through the location controller
are detected by the player station processor 84.
30   Thus, processor 84 and/or game computer 124 is able to
shut down the operation of a given player station 16
responsively to central computer 140 without affecting
the operation of the other player stations.

An alternate embodiment is provided in Figure 14.
35   Here, player stations 16 are disposed in a daisy-chain

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arrangement with respect to game computer 124. Rather
than communicating directly with each player station,
however, location controller 146 receives player
station information from a board 148. Board 148 may
include a processor, at least four serial ports and
appropriate memory as described with regard to such
components illustrated in Figure 4. It should be
understood, however, that board 148 may employ any
suitable circuitry, for example replacing the
processor with suitable logic circuits.

Game computer 124 accumulates information
associated with each player station and outputs
messages specific to a given player station to one of
the serial ports on board 148. The board 148
processor receives these messages and directs an
appropriate message to a particular serial port
corresponding to a particular player station 16. The
game computer and/or the board 148 processor may
configure the messages so that they are output at
these serial ports in a format compatible with local
controller 146. Thus, local controller 146 sees three
separate inputs corresponding to three separate player
stations, permitting these player stations to be
treated by central computer 140 as separate game
machines.

The processor of board 148 is programmed to
receive instructions from central computer 140 and to
output an appropriate message identifying the intended
player station 16 to game computer 124 so that game
computer 124 may take appropriate actions with respect
to that player station. Where the configuration of
central computer 140 and location controller 146
permit, board 148 may be omitted so that game computer
124 may communicate with the central computer through
the location controller over a single serial data

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line. Alternatively, location controller 146 may
communicate with game computer 124 over three serial
lines where game computer 124 includes sufficient
serial ports. It should also be understood that the
player stations of Figures 13 and 14 may be arranged
in a star configuration.

While preferred embodiments of the invention have
been described above, it should be understood that any
and all equivalent realizations of the present
invention are included within the scope and spirit
thereof. The embodiments depicted are presented by
way of example only and are not intended as
limitations upon the present invention. Thus, while
particular embodiments of the invention have been
described and shown, it will be understood by those of
ordinary skill in this art that the present invention
is not limited thereto since many modifications can be
made. Therefore, it is contemplated that any and all
such embodiments are included in the present
invention.